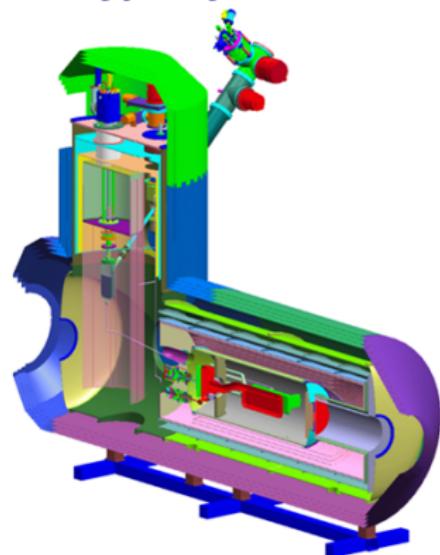


Neutron Guide Update

C. Crawford, G. Greene, W. Korsch, R. Redwine

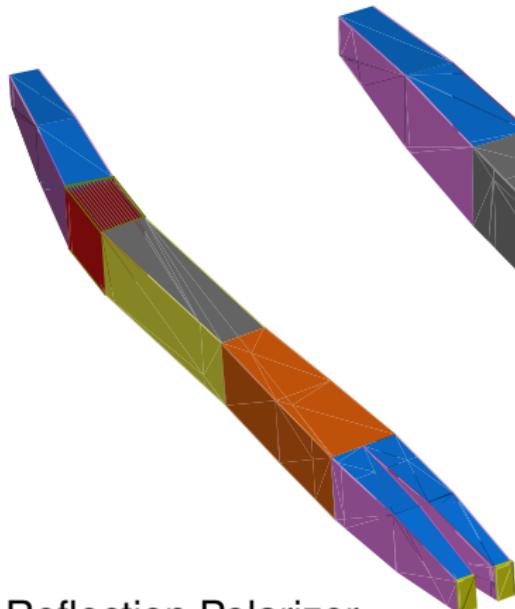
Chicago, EDM Collaboration Meeting
June 5, 2007

UK UNIVERSITY OF KENTUCKY
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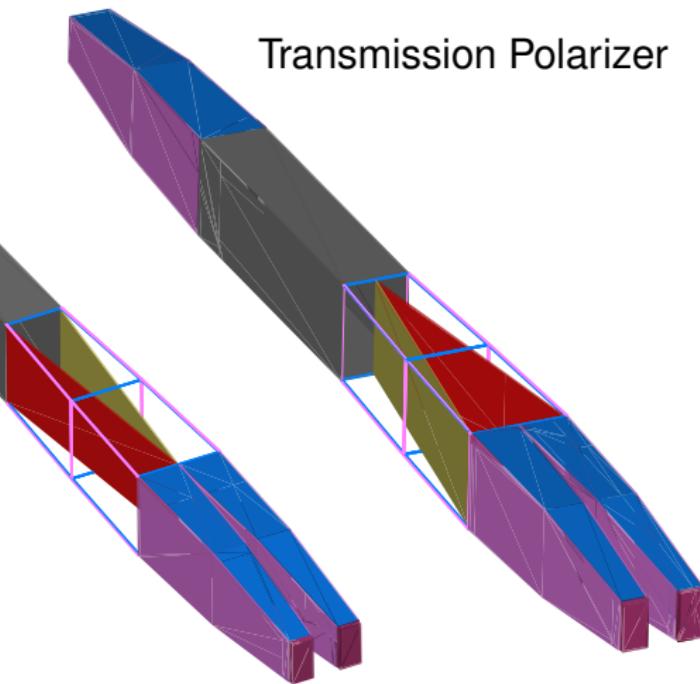


Different Polarizers

Transmission-Reflection Polarizer



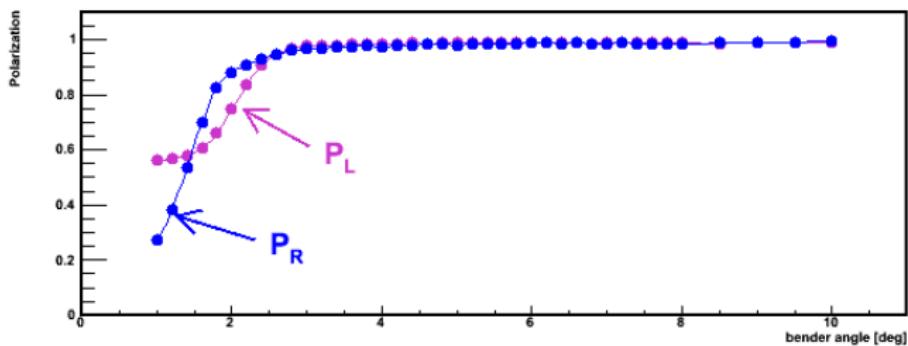
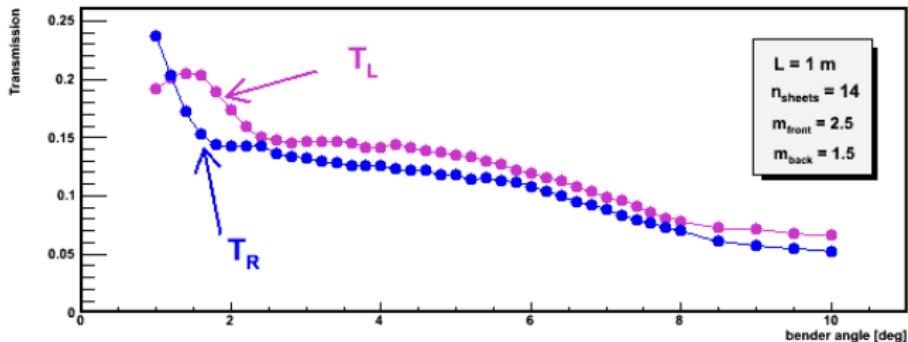
Reflection Polarizer



Transmission Polarizer

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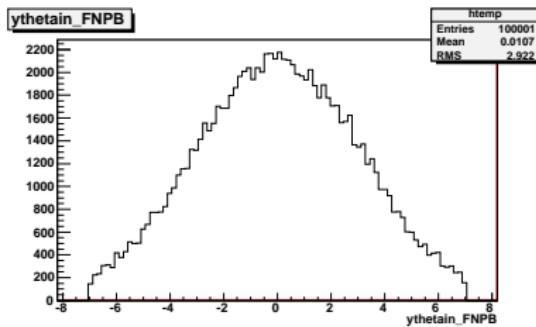
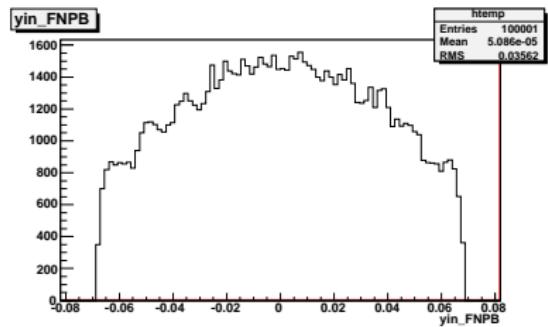
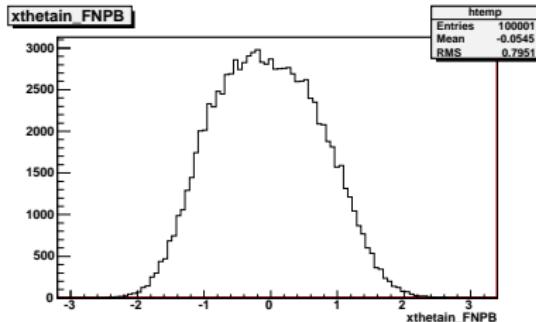
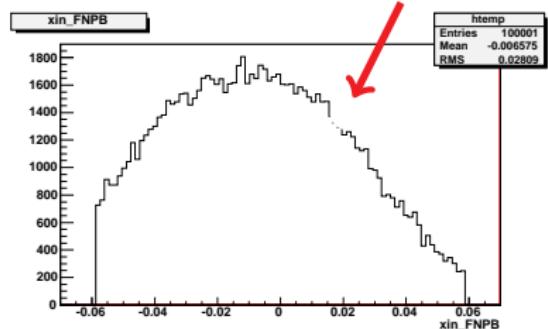
Reflection Polarizer: Asymmetries in Beam Parameters



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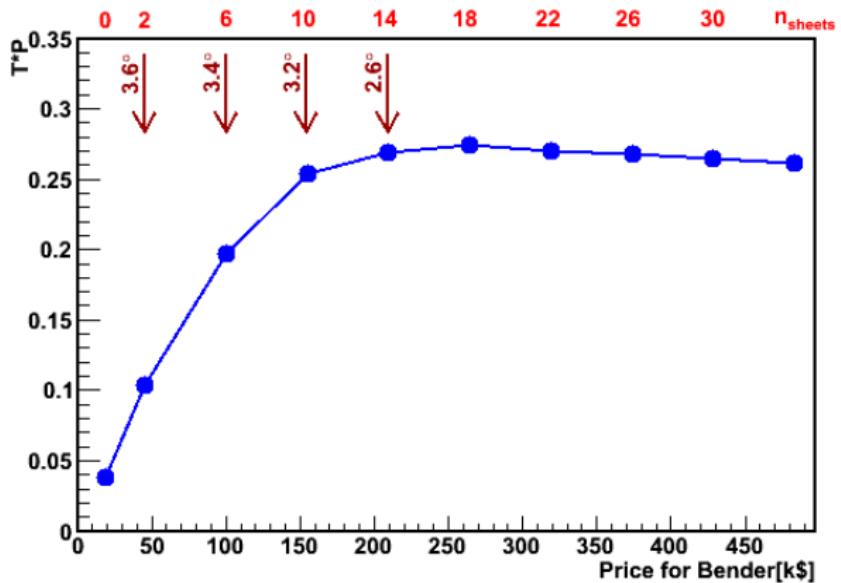
Neutron Beam Input Distributions

Note asymmetry



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Reflection Polarizer: Costs



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Comparison

- ✗ $T = T_L + T_R$
- ✗ Neutrons traced to the center of L^4He target, i.e. 55 cm behind end of guide (used a simple rectangular area)
- ✗ losses: $T_{\text{end of guide}} / T_{\text{target center}} \approx 1.47$ (T/R), ≈ 1.37 (Bender)
(Note: Polarizing sheets increase divergence)
- ✗ Extend beam guide closer to target?

comment	T	P	$T \cdot P$	ratio
T/R (no Si)	0.392	0.97	0.380	1.92
T/R (w/ 0.775 mm Si)	0.301	0.96	0.290	1.46
Bender	0.208	0.95	0.198	1.00
Transmission-only	not considered anymore			

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Cost Estimates

- Cost estimates for 15 m of beam guide
- Neutronics only

Reflection Polarizer

Component	Price [k\$]
11 m tapered guide	190
3 m splitter	174
1 m bender (19 sheets)	336
housing	133
sum (no cont.)	833
sum (30% cont., 23% curr. exch.)	1,274

Cost Estimates

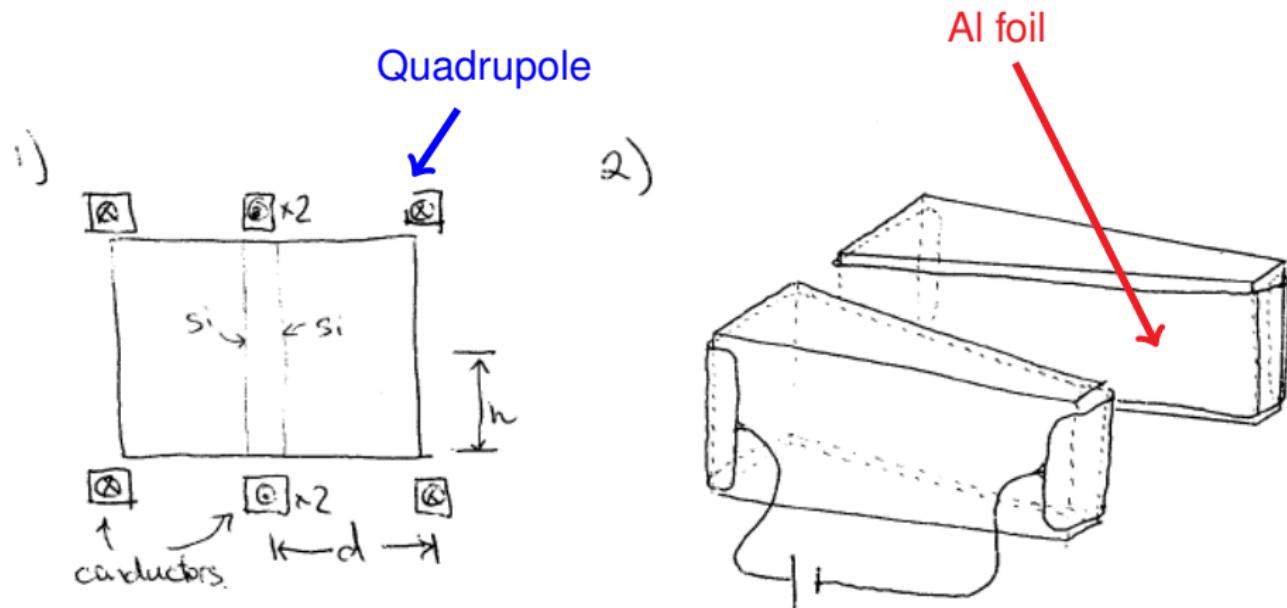
T/R Polarizer

Component	Price [k\$]
1 m straight section	15
11 m tapered guide	190
3 m splitter	174
11m Polarizer	313
Spin Rotator	82
housing	133
sum (no cont.)	907
sum (38% tech.cont., 23% curr. exch.)	1,460

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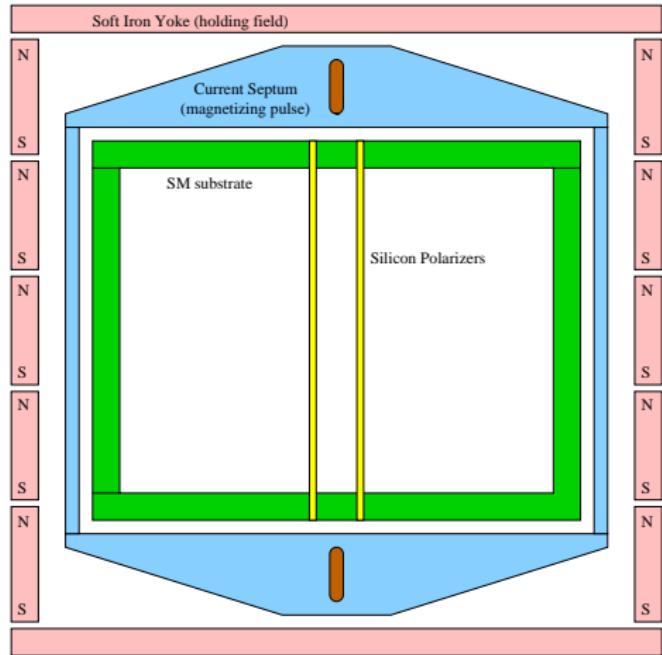
Possible Magnet Configurations for T/R Polarizer

Estimates performed by Chris.



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T/R Polarizer: Design Concept



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Comments and Estimates

- B-fields up to 300 G possible.
- Add'l losses due to Al sheet small (3 mil, $< 5 - 6\%$ (relative))
- Temperature increase reasonable ($T < 50^\circ\text{C}$ (quadrupole), $T < 5^\circ\text{C}$ (Al foil)).
- Inductance, resistance, \Rightarrow **reasonable values**
- Possible design to pulse current by means of a capacitor.
- Magnetic forces are sizeable, but can be dealt with.
- Need to design and build test setup (*additional R&D costs, $\approx \$100k$*).
- Need support of Si wafers (Rohacell^a?)

^aa polymethacrylimide low density rigid foam

- ✗ Simulations: Good agreement between McStas, Geant4, and Tito's code
- ✗ Two options: Bender or T/R polarizer
- ✗ Costs are “comparable” for two devices
- ✗ Bender “safe baseline design”
- ✗ R&D necessary for T/R polarizer → theoretical gain: 1.92
- ✗ T/R polarizer might be feasible → extra risks involved in realization
- ✗ Dropped Transmission-only Polarizer (absorption losses)